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Drivers of mobile payment acceptance: The impact of network externalities

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Abstract Mobile payment is an attractive option that has recently boomed because of the advent of smart phones and their applications. Despite the great potential of such technology in simplifying our lives, its uptake remains limited. As the technology acceptance fails to meet expectations, this study aims at providing a better understanding of the factors influencing mobile payment acceptance. Through an empirical investigation that couples the traditional technology acceptance factors with "network externalities" effect. This study hypothesized that performance expectancy, effort expectancy; social influence, trust, and network externality are major factors that influence the intention to use mobile payment. Results indicated that while the traditional acceptance drivers still impact customers' willingness to adopt mobile payment, network externalities was the most influential driver of mobile payment acceptance. Results also failed to support the influence of effort expectancy. Conclusions and future work propositions are stated at the end.

Keywords Nigeria, Mobile payment acceptance, Technology acceptance, UTAUT, Network externalities

1 Introduction

Mobile payment is part of mobile financial services that en-compasses conducting financial activities using a mobile phone (Dass and Pal 2011). Some researchers claim that defining mobile payment as a way to access Internet payment services using mobile devices is not accurate, although the realized functionality is the same, but the context is different (Karnouskos and Fokus 2004). Mobile payment is a combination of mobile technology and a payment system that enables the consumer to pay for goods and services via mobile devices (Chandra et al. 2010; Lu et al. 2011). All mobile payment definitions refer to some kind of monetary value transfer (Henkel 2002), with three main entities: the mobile service provider (e.g., Zain or Orange companies), the mobile payment vendor (e.g., retailer shop or e-commerce site), and the mobile technology in use (e.g., 3 g network or RFID) (Xin et al. 2013).

Nigeria recorded a high percentage in Internet penetration, and even in social and e-commerce website accessibility, where Internet penetration in the country accounted for 65 %and is expected to reach 85 % by the year 2017 (Ghazal 2014). The author claims that 97 % of Nigerians own mobiles, which is a great foundation for mobile payment. Still with this high penetration, it is lagging in terms of real transactions and payments. The experiences from other countries of the world indicated that small payments are more common on mobile phones, but even this did not boom except in the last few years. In China, mobile payments increased up to 255 % in the first quarter of 2014 (Marketingchina.com 2015). The website indicates that mobile payment market will account for $623 billion.

Such situation calls for more research on mobile payment acceptance. As we are focusing on technology-based payment (through mobile devices), it is important to utilize one of the many well research models in technology adoption. This study utilized one of the famous and comprehensive theories in technology adoption as the basis for our conceptualization, and extended it with two important constructs. The Unified

Theory of Acceptance and Use of Technology (UTAUT) is a well established model that utilized four major constructs in the pursuit of influencing intention to use a technology. The four major predictors in the UTAUT are: performance expectancy, effort expectancy, social influence and facilitating conditions.

On the other hand, and as technology adoption theories are technology specific, it is important to think of other constructs that are related to the technology or context we are exploring. Trust is an important model that is closely related to financial transactions. Trust becomes important when it is related to monetary value and more important when the transaction is conducted via wireless network. Trust has proved to be a robust construct in predicting the intention to use a technology. The second extension we proposed is related to the characteristic of the network we are using and thus we imported network externality to predict technology adoption. In developing countries, economic status is influencing users choice of a mobile network, thus influencing the use of any application related to technology.

This paper is divided as follows: the following section will explore the literature related to the topic and the major parts discussed: UTAUT, trust, and network externalities. Also, mobile technology and mobile payment will be discussed in a fourth subsection of the literature review. The third section will describe the method used to tackle the research question and hypotheses. Section four will cover the data analyses and discussion. Finally, the conclusions and future work are discussed at the end.

2 Literature review

Research, in the area of technology adoption, aims at understanding the factors that predict peoples' adoption decision regarding a specific technology. One of the important models is the Unified Theory of Acceptance and Use of Technology (UTAUT) proposed by Venkatesh et al. (2003). When exploring the technology adoption of mobile payment, it is important to think of trust and network externalities. The following three sections will explore the three dimensions of our proposed conceptual framework.

2.1 The unified theory of use and acceptance of technology

The UTAUT model was originally presented with four main constructs: performance expectancy, effort expectancy, social influences, and facilitating conditions. The model presented an advanced understanding of technology acceptance by unifying multiple theoretical perspectives, and incorporating dynamic influences by adding four moderating variables (age, gender, experience and voluntariness of use) that solidify the explanatory abilities of the model (Wang et al. 2008b). Still, it explained 70 % of the variability of users' technology usage intentions. The UTAUT integrated eight theories and models in the field of technology acceptance and human behavior including TRA (Theory of Reasoned Action), TAM, MM (Motivational Model), TPB (Theory of Planned Behavior), C-TAM-TPB (combined TAM and TPB), MPCU (Model of PC Utilization), IDT and SCT (Social Cognitive Theory) (Venkatesh et al. 2003).

Despite its short comings, empirical investigations have repeatedly shown that the UTAUT model serves the purpose of studying the factors influencing technology acceptance and behavioral intentions better than competing models (Venkatesh et al. 2003; Park et al. 2007; Abu-Shanab and Pearson 2007; Zhou 2013a; Nysveen and Pedersen 2014). Due to the model's sensitivity to cultural aspects, it was found suitable for cross cultural studies. The UTAUT model has the ability to highlight and uncover cultural differences, and it can withstand translation issues (Oshlyansky et al. 2007).

The model was then extended to include hedonic motivation (using the technology is fun and enjoyable), price value and habit. Users tend to have more positive behavior towards using a particular technology if they felt it is fun (Brown and Venkatesh 2005). Habits can be defined in two ways: habits can refer to past behavior (Kim and Malhotra 2005), or as the extent to which an individual performs a behavior using IT automatically because of the learning process (Limayem et al. 2007). The second one fits with information technology usage. Research indicated that habit in the form of prior behavior was closely linked to technology acceptance (Venkatesh et al. 2012).

Even though the UTAUT model covered most variables needed to provide an understanding of technology acceptance and use intentions, it is important to note that the results regarding the relative importance of all four major constructs of the model varied widely and inconsistently with no clear pattern. This conclusion was more potent especially across different countries. This makes it extremely important to any researcher employing the UTAUT model or attempting to extend it to carefully pick the constructs that he/she wishes to include in his/her study and cautiously choose the data analysis method to guarantee valid results (Attuquayefio and Add 2014). And not to forget that the model may need to be adjusted to accommodate for the differences between countries (Cheng et al. 2011).

Effort expectancy: the term effort expectancy refers to how comfortable, and easy to adopt customers feel the technology will be. This factor is an important predictor of technology acceptance (Abu-Shanab and Pearson 2007). Effort expectancy usually turns out to be of higher significant in early adoption. Effort expectancy captures the meaning of both ease of use and complexity (Baron et al. 2006). Effort expectancy indirectly impacts behavioral intentions through performance expectancy, This means that if a customer think that using a

particular technology will need huge effort, their perception of that technology will be decreased (Zhou 2011). This construct is believed to have a significant influence on behavioral intentions towards technology acceptance in early stages, but its impact diminishes over long periods of continues usage (Venkatesh et al. 2003), and some research failed to support its influence when testing for e-recruitment systems (Laumer et al. 2010).

Performance expectancy: this factor encompasses other factors in technology acceptance including perceived usefulness, relative advantage and outcome expectation. Venkatesh et al. (2003) defined the term as the degree to which the user thinks using a particular technology will improve the overall performance. Previous research stressed this construct as one of the strongest predictors of technology acceptance (Louho et al. 2006; Al-Shafi and Weerakkody 2009; Abu-Shanab et al. 2010; Zhou 2013b).

Facilitating conditions: the term facilitating conditions is used to refer to the degree to which technical and organizational infrastructure that facilitates the use of a particular technology is already in place (Attuquayefio and Add 2014). It yielded significant influence for some research in declining the adoption process jointly with compatibility (Zhang et al. 2011). It comprises three main constructs: 1) perceived behavioral control including internal and external behavioral constraints, 2) facilitating conditions: which refers to objective factors within the environment that make using a particular technology easy, and finally, 3) compatibility: how compatible is this new technology with the values and needs of its expected users (Venkatesh et al. 2003). As technology adoption is a technology specific domain, the abundance and ubiquity of mobile technology would be considered important for the adoption process, which emphasizes the role of facilitating conditions as a predictor of behavioral intention (Peng et al. 2011).

Social influences: referred to as external influences. Social influence is the pressure exerted by members of the social surroundings of an individual to perform or not perform the behavior in question (Taylor and Todd 1995). Social influence was reported by research to significantly impact behavioral intentions (Hong and Tam 2006). Social factors influence customers' behavior in three ways: identification, internalization and compliance. While the earlier two factors refer to alterations in an individual's believe structure in hope of a potential status gain, compliance refers to change in the believe structure of an individual caused by social pressure (Venkatesh et al. 2003).

It's believed that the significance of social influence as a driver of technology acceptance arises from the presumption that individuals tend to consult with important people in their environment to reduce the anxiety attached with the use of a new innovation (Slade et al. 2014). In addition to such conclusion, researchers proclaimed that external influences and social image have a great significant prediction of customers' behavior (Liébana-Cabanillas et al. 2014; Chung et al. 2010; Suntornpithug and Khamalah 2010).

2.2 Trust

In this scenario, trust is defined as the willingness of one party (purchaser) to be vulnerable to the second party (virtual establishment) and allow it to conduct important actions on their behalf. This level of willingness is reached knowing that purchasers cannot exert any type of control over that virtual establishment (Van Der Heijden et al. 2003). Trust has a significant influence on customer acceptance of mobile payment. Research indicated that it does not only influence use intentions but also use continuity (Slade et al. 2014).

Buying online is not widely spread in Nigeria and research indicated that trust and other socio-cultural factors are influ-ential in the domain of online buying (Abu-Shamaa and Abu-Shanab 2015). It is also proclaimed by some researchers that better information and service quality can promote customers' trust (Zhou 2013a), but the influence of such factors varies between inexperienced and experienced customers (Liébana-Cabanillas et al. 2014). Inexperienced customers tend to build their perceptions and opinions based on the opinions of other people in their social surroundings (close to social influence perceptions). Based on that, trust seems to be a major predictor of technology acceptance (Yang et al. 2012), an important factor in financial services adoption (Arvidsson 2014), and vital in the field of mobile payment as it creates a positive utility perception in customer's mind towards mobile payments (Zhou 2011).

Trust influences the customer's likelihood of accepting a given technology (Gefen 1997). Surprisingly, trust is an under investigated variable (Dass and Pal 2011). But given that mo-bile payment is a monetary related technology, our trust in the party that guarantees the value of our money (a central bank or a card payment framework provider) is essential to the tech-nology acceptance. Trust in mobile payment is the combina-tion of our trust in the service provider and the technology itself (Arvidsson 2014). Trust yielded significant prediction of ITU mobile payments when combined with PU, PEOU, price and peers influence (Yan et al. 2009). In the Nigerian context, trust was well researched in the context of e-govern-ment, where previous studies differentiated between trust in technology (surrogate to mobile payment) and trust in govern-ment (surrogate to merchant), where both constructs were sig-nificant predictors of BI (Abu-Shanab and Al-Azzam 2012; Abu-Shanab 2014). In conclusion, and given the great importance of trust as an antecedent of mobile payment acceptance, service providers should take that into account by focusing primarily on activities that should boost customers trust (Slade et al. 2014).

2.3 Network externalities

Network externalities influence exists when the perceived value of the service or the product increases as the number of users increases (Economides 1996). Network externalities explain how the utility of the product or service in question is linked to the number of its buyers. There are three types of network externalities that explain such relationship and they are the following: Direct network externality effect, the positive influence, and the indirect effect of network. The direct network externality effect is felt directly as the number of users or customer for a product or a service rises, for example as the number of users to a particular SNS rises. The positive influence is felt directly as the user becomes able to interact with a larger number of users. The indirect effect of network externalities is felt as a result of an increment in product/service utility induced by the increment of the number of users. For example the wide adoption of windows operating systems, led to an increase of the number of software applications running on them. Network externalities also has an indirect effect that can be felt by the user as the increase in the number of buyers causes an improvement in the availability and quality of after sale services (Katz and Shapiro 1985).

The externality effect has been studied as a factor influencing the acceptance of many IS technologies, especially those that share the characteristics of network goods (Shapiro and Varian 1998). With regard to mobile communication, service network externalities have an impact on user's acceptance and use intentions. It is suggested therefore, that service providers design strategies that work on increasing the initial number of users, to convey to customers that the technology is well established, and will become standard in the near future (Wang et al. 2008a).

2.4 Related work

The UTAUT model has been employed for the purpose of studying the factors influencing mobile payment acceptance. Research found that effort expectancy, performance expectancy and social influence have a significant direct impact on customers' behavioral intentions (Abu-Shanab and Pearson 2007; Alshare et al. 2009). These findings were also supported by Peng et al. (2011) and Thakur (2013) who included facilitating conditions and have found it a significant predictor as well. Most of research utilizing the UTAUT constructs employed an empirical research with a survey technique.

Dahlberg and Mallat (2002) concluded that network externalities had an impact on customer's acceptance of mobile payment through qualitative analysis. In this study the researchers conducted interviews with the respondents to explore the impact of several factors along with network externalities. Despite its interesting findings, the small sample size limited the external validity of the results. Mallat (2007) later studied the impact of network externalities on customers' acceptance of mobile payment. This research studied the impact using focus group technique, which also suffered from the issue of results generalizablity.

2.5 Mobile payment

Even though the term "mobile payment" includes all mobile devices including PCs and PDAs, the general use of the term often refers to mobile devices with mobile phone capabilities (Karnouskos and Fokus 2004). For the purpose of this research, we accept any activity initiation, activation and confirmation as a form of mobile payment.

There are two major categories of mobile payments and the distinction between them is based on the location of the customer (purchaser), relation to the merchant (seller), and different use scenarios. Mobile payments also are classified as remote payments or proximity payments (Zhou 2011): Proximity payments or point of sale payments refer to payments that take place when the customer is in close proximity to the merchant. In this type of payment, the credentials are stored on the mobile phone and exchanged within a small distance using barcode scanning or RFID technology (Chen et al. 2010). Near field communication (NFC) is seen as the most promising technology in proximity payments; gaining higher popularity among consumers and merchants as well. The customers' base for the technology is getting larger, as it offers them more convenience and security (Zhou 2011; Ondrus and Pigneur 2009).

Research has shown that Near Field Communication (NFC) presents mobile operators, banks, and businesses with a faster, and more convenient way for transactions (Beygo and Eraslan 2009). NFC devices provide three different operating modes: Peer-to-peer mode, where two devices exchange data with one another like in a Bluetooth session; The Reader/writer mode, where the device is used to initiate a connection or to target the tags or smart cards; and the Card emulation mode: where the device acts as a contactless card. Example: Contactless payments or ticketing (Gilje 2009; Beygo and Eraslan 2009).

The second type of payment is remote payments. This type of mobile payments is similar to online shopping scenarios (Chandra et al. 2010), where it covers payments that are conducted via a mobile web browser or a Smartphone application. Mobile phones produced in the last few years are supported with capabilities that make them suitable for this payment method (SMS, secure mobile browsing sessions and mobile apps). This payment method can be conducted using the already existing infrastructure (The Mobile Payments 2011). While remote payments seem to be more mature than proximity payments (as the earlier enjoy a larger more flexible market, and the later suffer from time and place restrictions), both types can be integrated to improve the future market of

mobile payment technology (Zhou 2011). The later can only used within a close range of the point of sale (Gilje 2009).

3 Research method

The UTAUT model is suitable for the purposes of this study since it has high explanatory abilities, where it consolidated several theories and models of the technology acceptance area (Venkatesh et al. 2003). The model is used to study the factors influencing customers' behavioral intentions towards mobile payment, which is the main surrogate used for the use behavior.

Upon examining the literature in the field of mobile payment, some constructs stood out as important predictors of mobile payment acceptance that were not included in the UTAUT model. Other constructs included in the original model have been repeatedly proven to be insignificant, or have very little to do with customers acceptance of mobile technology. Also, The UTAUT and its modified version (UTAUT2) also included the use construct, which makes PFC out of our scope.

In hope of improving the explanatory abilities of the UTAUT model, it was modified. First, trust was added to the model, since it gained especial importance in literature when dealing with financial transactions. Customers consider their ability to trust the technology as well as the service provider when they conduct any financial service (Arvidsson 2014).

It is widely agreed that mobile services in general are subject to network externality effect, as the value of these services in general increases as the number of users' increases (Wang et al. 2008a). Mobile payments are no exception, their value and perceived benefit increases when the number of merchants and customers using this payment method increases (Song et al. 2007). Many people using Amzon.com or eBay services pick the seller with the highest number of ratings, which indicates a validity and consistency of value of service. Such argument is more potent when related to developing countries and the limited income.

On the other hand, the facilitating conditions (one of the constructs of the original UTAUT), does not seem to have significant influence on mobile payment acceptance (Dass and Pal 2011; Peng et al. 2011), and according to the original model, facilitating conditions influence actual usage directly, therefore this construct is to be eliminated from the model as the research focuses on behavioral intention rather than use behavior. Figure 1, illustrates the proposed research model.

3.1 Research objective and hypotheses

This study aimed at exploring the factors influencing the intention to use mobile payment methods. This objective is attained by investigating the literature and summing the major factors that are conceptually expected to influence behavioral intentions (BI). The following discussion will elaborate on the set of hypotheses assumed based on the research model proposed.

Effort expectancy is defined as the degree of perceived easiness associated with using a particular technology (Venkatesh et al. 2003). If an individual perceives using a particular technology easy, then he/she will have stronger inclination to use it (Teo et al. 1999). Previous research has shown that the more the customer believes using mobile payment is effortless, the stronger their intentions to use it (Alshare et al. 2004; Thakur 2013). Thus:

> H1: effort expectancy (EE) has a positive influence on customers' intentions (BI) to use mobile payments.

Performance expectancy refers to the extent to which an individual believes that using a particular technology will improve his/her performance (Venkatesh et al. 2003). If a user thinks that using a particular innovation will improve his/her performance, he/she is more likely to use it (Morris and Venkatesh 2000). In the literature published in the area of mobile payment acceptance, it is widely accepted that if a

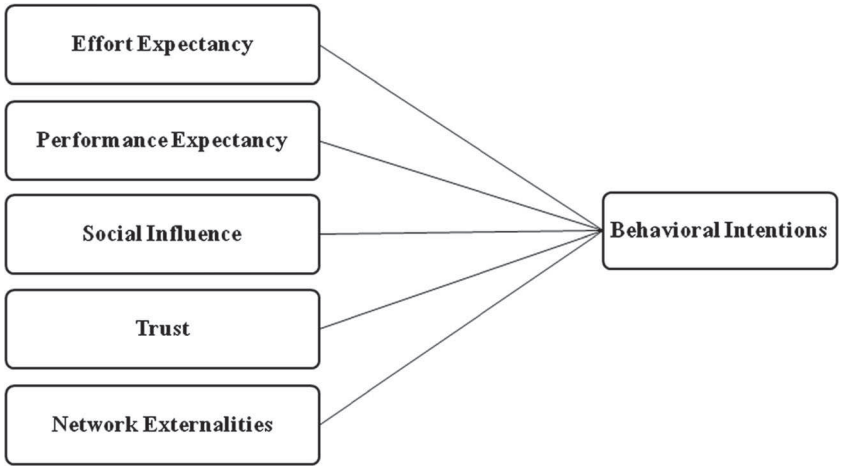

Fig. 1 Research model

customer believes that using mobile payment will be helpful they will have a stronger tendency to adopt the technology (Alshare et al. 2004; Peng et al. 2011; Thakur 2013). Thus:

> H2: Performance expectancy (PE) has a positive influence on customers' intentions (BI) to use mobile payment.

Social influence is defined as the social pressure exerted on an individual by close people in his/her social surrounding, to use or not to use an innovation (Venkatesh et al. 2003). This factor has proven its significance as a predictor of technology acceptance in various contexts. In the area of mobile payment acceptance research confirms that social pressure impacts user's willingness to use mobile payment systems (Alshare et al. 2004; Peng et al. 2011; Yang et al. 2012). Thus

> H3: Social influence (SI) has a positive influence on customers' intention (BI) to use mobile payment.

Trust in the on-line environment is defined as the willingness of the customer to be vulnerable to the vendor after considering the vendors characteristics, who intern is expected to provide an agreed upon service (McKnight et al. 2002). Trust influences the customer's likelihood of accepting a given technology (Gefen 1997; Jarvenpaa et al. 2003). In mobile payment context, the customers' competence in mobile payment system should drive their acceptance towards it (Zhou 2011; Arvidsson 2014; Chandra et al. 2010; Xin et al. 2013; Shin 2009). Thus

> H4: Trust has a positive influence on customers' intentions (BI) to use mobile payment.

Network externalities influence exists when the benefit of using a product increases as the number of people using it increases (Haruvy and Prasad 1998). Payment systems are subject to the network externality effect (Van Hove 2001). In mobile payment context, customers seem to be sensitive towards the number of technology users, and they consider the large customer base a prerequisite for the adoption decision (Dahlberg and Mallat 2002; Mallat 2007). Moreover, the more merchants offer mobile payment services the more willing the customers are to accept them (Au and Kauffman 2008). Thus:

> H5: The number of mobile payment users (merchants & customers) has a positive influence on customers' intentions to use mobile payment.

3.2 Instrument development

This study used a questionnaire to measure the dimensions of the proposed constructs in the research model. To insure the validity of the instrument, the items of the questionnaire where adapted from the literature. The wording of items was modified to fit with the mobile payment context (the technology under research). The questionnaire utilized a five points Likret scale ranging from strongly disagree to strongly agree.

As the original items were reported in the literature in English language (see Appendix Table 8), they had to be translated to Arabic. Back translation was used to insure the quality of the translation (Brislin 1970). Furthermore, to make sure that the translated questions intuitive and fit with the specific culture of Nigeria (relating to the original language), the questionnaire was translated using back translation (Harkness and Schoua-Glusberg 1998). The resulting final items were used in the survey and distributed to subjects.

3.3 Sampling and questionnaire distribution

Based on the low penetration and use of mobile payments in Nigeria (Ghazal 2014), it might be difficult to find a sample of Nigerian citizens who can respond to the issues proposed by this study accurately. The targeted sample size was 300, where most of the surveys were handed to respondents by the re-searchers themselves. The researchers employed voluntarily six contact people to help in collecting data. The contact group included high school teachers, master students, and the re-searchers themselves. A small number of surveys were sent to subjects living outside the country (Nigerian nationals). The research team picked subjects randomly in their environ-ments (in schools for teachers) and then asked about mobile payment and then delivered the survey to those who knew the topic and are acquainted with its details.

The survey distribution took place between the 5th and the 13th of December, 2014. Participation was voluntary and no incentives were given to participants. The target sample size was not reached; out of the 280 surveys distributed 258 were retrieved, and after a preliminary visual assessment 253 sur-veys were found usable. Subjects of the study can be consid-ered a representative sample of the distribution in the Nigerian population, representing different age groups, edu-cational levels, and average income. Such representation might divert from the distribution percentages, but still includ-ed major categories.

4 Data analysis and discussion

The surveys collected (total 253) were keyed into an Excel sheet and then imported into SPSS, and AMOS 20. The anal-ysis needed to answer the research questions and test the hy-potheses was conducted. The following sections will describe the data analysis and discuss the results obtained.

Table 1 Sample demographics

Gender	Count	%	Age	Count	%
Male	77	30.7 %	Less than 20	59	23.5 %
Female	170	67.7 %	20–40	146	58.2 %
Not reported	4	1.6 %	More than 40	39	15.5 %
Total	251	100 %	Not reported	7	2.8 %
			Total	251	100 %
Education	Count	%			
High School or less	27	10.8 %	Income *(in* Nigeria Naira*)*	Count	%
Bachelor	160	63.7 %	Less Than N400	56	22.3 %
Master/PhD	30	12 %	N400–N800	119	47.4 %
Other	24	9.5 %	More than N800	56	22.3 %
Not reported	10	4 %	Missing	20	8 %
Total	251	100 %	Total	251	100 %

4.1 Preliminary analysis

For the purpose of understanding the impact of outlier data cases, an initial multiple regression test was performed on the 253 responses. Based on the case-wise diagnostics, two cases had a standard residual of −3.0, −3.7. Both cases were omitted from further analysis, making the total sample size 251. Table 1 summarizes the demographic features of the sample in terms of gender, age, education and income respectively. The sample represents more females than males, more middle age subjects than older/younger, more bachelor degree holders than other degrees, and finally, more middle income subjects than lower or higher income subjects. The sample demographics are close to what we can consider an aware population of the topic.

The second preliminary analysis is to check for the extreme values of correlations between any of the independent variables. If so this will affect both the magnitude and the direction of the betas in the regression equation. The more the independent variables overlap the harder it is to correctly estimate their individual impact on the dependant variable. For such purpose, two major tests are used: inspection of the correlations matrix, and the collinearity statistics. The correlation matrix estimate will be depicted later in the analysis.

For the collinearity test, the tolerance and variance inflation factor (VIF) are estimated (shown in Table 2). A tolerance value for each of the independent variable indicates the extent to which that particular variable influences other independent variables. The variance inflation factor (VIF) indicates the amount that the variance of each regression coefficient is increased over that with uncorrelated independent variables. Lower values of tolerance (0.1 and less) and higher values of VIF (2.5 and more) are indicators of multi-collinearity. Since all values of both tolerance and VIF in Table 2 are within acceptable limits, it is concluded that there isn't any multi-collinearity issues and the independent variable are not predicting each other extremely.

Table 2 Collinearity statistics

Independent variable	Tolerance	VIF
Effort expectancy	0.533	1.877
Performance expectancy	0.513	1.950
Social influence	0.698	1.432
Trust	0.667	1.500
Network externalities	0.550	1.819

Cronbach's alpha was used to measure the internal consistency between the items of the survey that are used to measure each one of the independent variables and the dependant variable as well. Alpha values higher than 0.6 are considered acceptable in social sciences (Nunnally 1978; Hair et al. 2009; Abu-Shanab and Pearson 2009). The reliability measures listed in Table 3 indicates that the items used to measure each one of the variables are highly consistent.

4.2 Factor analysis

To help understand how the measurable variables identify the factors they are believed to represent, a confirmatory factor analysis was conducted. Table 4 depicts factor loadings, construct reliability, average variance extracted, maximum shared variance and average shared variance. As an indicator of how will the measurement model is served by the underlying measured items, factor loadings that have values higher than 0.5 are considered significant. All factors included in this study are significant (Shown in Table 4) except for Q14 which had a 0.48 loading (<0.5) and therefore should not be included in the analysis (Hair et al. 2009).

Construct reliability (CR) is another measure of internal consistency for each one of the model constructs. CR values that are more than 0.7 indicate a good reliability. All model constructs have a CR>0.7, as illustrated in Table 4. Also, the average variance extracted (AVE) is an indicator of the

Table 3 Cronbach's alpha (with the item means and standard deviations)

Variable name	Item	Mean	Standard deviation	Cronbach's alpha	Number of items
Effort expectancy	Q1	3.64	1.19	.868	4
	Q2	3.65	0.98		
	Q3	3.69	1.05		
	Q4	3.78	1.11		
Performance expectancy	Q5	3.61	1.12	.816	4
	Q6	3.74	0.99		
	Q7	3.93	0.95		
	Q8	3.50	1.02		
Social influence	Q9	3.16	0.99	.761	3
	Q10	3.21	0.94		
	Q11	3.30	1.04		
Trust	Q12	2.96	1.17	.734	4
	Q13	3.12	1.05		
	Q15	3.42	1.05		
Network externalities	Q16	3.42	1.21	.759	3
	Q17	3.73	0.98		
	Q18	3.65	1.11		
Behavioral intentions	Q19	3.24	1.14	.864	3
	Q20	3.48	0.98		
	Q21	3.38	1.10		

adequacy of convergence when the AVE values are higher than 0.5. This means that the variance due to the construct itself is greater than the variance due to error. AVE for all constructs is higher than 0.5 (Hair et al. 2009).

Convergent validity indicates that the factors that make up a construct are not redundant, i.e., they measure different aspects of it (Hair et al. 2009), and therefore do not extremely correlate with one another. To test for convergent validity, all factors estimated are recommended to have CR or AVE>0.5. Results shown for this measurement model supported such required thresholds.

Table 4 Factor analysis results

Item		Factor loading	Construct Reliability	Average variance extracted	Maximum Shared Variance	Average Shared Variance
Effort Expectancy	Q1	0.75	0.883	0.654	0.453	0.293
	Q2	0.83				
	Q3	0.81				
	Q4	0.83				
Performance Expectancy	Q5	0.75	0.839	0.567	0.453	0.339
	Q6	0.85				
	Q7	0.63				
	Q8	0.67				
Social Influence	Q9	0.77	0.761	0.517	0.276	0.233
	Q10	0.64				
	Q11	0.75				
Trust[a]	Q12	0.92	0.815	0.601	0.348	0.227
	Q13	0.65				
	Q15	0.71				
Network Externalities	Q16	0.87	0.813	0.596	0.453	0.327
	Q17	0.77				
	Q18	0.65				
Behavioral Intentions	Q19	0.84	0.869	0.688	0.453	0.369
	Q20	0.87				
	Q21	0.78				

[a] Item # 14 was removed from the analysis based on factor analysis

Table 5 Correlations matrix

Constructs	EE	PE	SI	T	NE	BI
Effort Expectancy (EE)	1					
Performance Expectancy (PE)	0.626**	1				
Social Influence (SI)	0.365**	0.398**	1			
Trust (T)	0.351**	0.407**	0.489**	1		
Network Externalities (NE)	0.577**	0.582**	0.374**	0.451**	1	
Behavioral Intentions (BI)	0.535**	0.626**	0.476**	0.535**	0.643**	1

**Correlation is significant at the 0.01 level (2-tailed)

Discriminant validity means that the factors used to measure each construct correlate with each other more than they do with other factors. To establish discriminant validity both the average shared variance (ASE) and the maximum shared variance (MSV) have to be less than the average variance extracted (Hair et al. 2009). The measurement model supported also such values.

4.3 Testing the hypotheses and the model fit measures

Before testing our hypotheses, we need to inspect our basis for assuming such variables. The bivariate relationships between all variables indicate more than one dimension. The correlation matrix in Table 5 explains how the independent variables contribute to explaining the variance of the dependant variable (behavioral intentions). The matrix indicates that effort expectancy, performance expectancy, social influence, trust, and network externalities correlated significantly with behavioral intentions (with a $p<0.01$ or less). It's important to note that performance expectancy and network externalities seem to have the highest bivariate effect on behavioral intentions.

The second indication of the correlation matrix is the extreme values (either low or high), where extreme low correlations (beta values) indicate an insignificant relationship, which contradicts with our conceptual assumption of the importance of this variable in predicting behavioral intentions. On the other hand, extreme high values of correlations between any two variables indicates a similarity of measure (may be explained as a tautology when the value of beta is larger than 0.8). Inspecting Table 5, we see no values that are higher than 0.8 or lower than 0.2. This supports our assumption of the significant relationship between BI and each one of the independent variables.

To evaluate the goodness of fit for the model, the values of chi square, the degree of freedom, the CFI and the RMSEA must be examined. The research model in this study was tested using AMOS 20. Table 6 includes the values of the mentioned indices and their acceptable thresholds. Results indicate a good fit for the research structured model, where all the values reported are within acceptable limits.

The results of the model indicated a significant prediction by all independent variables except for effort expectancy. The prediction of the model reached 58 % (R^2= 0.579, adjusted R^2=0.567), which can be considered an acceptable explanation power (more than 0.4 according to Cohen and Cohen (1983)). Table 7 shows the estimated relationships and their corresponding standardized beta and the results of hypotheses testing. The prediction equation can be stated as follows:

$$\mathbf{BI = 0.35\ PE + 0.13\ SI + 0.22\ T + 0.34\ NE + error}$$

4.4 Discussion of results

Despite the acceptable predictive abilities of the research model, effort expectancy (H1) did not have a significant

Table 6 Model fit measures

Index	Value	Threshold values (Source: Hair et al. 2009)
Chi-square	333.092, $P<0.001$	Significant
Degree of freedom	151	
$\chi 2$ /df (deg. of freedom)	2.206	<0.3
CFI	0.927	>0.90
TLI	0.908	>0.90
RMSEA	0.069	<0.07 significant given that the sample size is >250 and the CFI >0.92

Table 7 The set of relationships and their corresponding standardized betas

Hyp #	Relationship	Result	Stand. Beta
H1	Effort expectancy → Behavioral intentions	Not-Supported	0.04
H2	Performance expectancy → Behavioral intentions	Supported	0.35
H3	Social Influence → Behavioral intentions	Supported	0.13
H4	Trust → Behavioral intentions	Supported	0.22
H5	Network externalities → Behavioral intentions	Supported	0.34

influence on behavioral intentions. Even though it did correlate significantly with behavioral intentions in a bivariate relationship (see Table 5). But when competing with other variables, effort expectancy seems to have lost its significance. This means that while Nigerian customers place some importance on mobile payment ease of use, the high penetration and daily usage of mobile phones make effort expectancy for this relatively new mobile based technology less important (Faria 2012). While some researchers have found effort expectancy significant (Alshare et al. 2004; Thakur 2013), our finding is supported by previous research (Wu et al. 2007).

As indicated in the previous section, performance expectancy is a significant predictor of customers' acceptance of mobile payment (H2). These results suggest that the Nigerian customers put a high value on the relative advantage of the technology. They believe that mobile payment carry a possible improvement for their performance and transactions. It is expected that customers compare the expected advantage of using current payment methods to using mobile payment when deciding to adopt such technology. These results come in line with previous research (Alshare et al. 2004; Peng et al. 2011; Thakur 2013).

Similar to this, social influence is also a significant predic-tor of the customers' behavioral intentions towards using mo-bile payment (H3). Social influence positively impacts cus-tomers' acceptance of mobile payment. Customers' willing-ness to use mobile payment is influenced by the opinions of other individuals in their surroundings. If people whose opin-ions matter to us think that using mobile payment is good then we are more likely to use it. This link is already established in previous literature (Alshare et al. 2004; Peng et al. 2011; Yang et al. 2012).

The model proposed in this study extended the UTAUT with two important variables: trust and network externalities. Trust was a significant predictor of mobile payment accep-tance (H4 was also supported). It is important for customers to be able to trust the technology as well as the service pro-vider prior to using mobile payment for conducting any finan-cial transaction. This supports our emphasis of the monetary nature of the technology and how it inflects such significance on the transaction and the intention to conduct it via mobile technology.

Network externalities were found the most significant predictor of mobile payment acceptance (H5 was also supported). This factor uniquely predicted 23.7 % of customers' behavioral intentions towards mobile payment. Clearly customers are more likely to use mobile payment if enough merchants accept this payment method, they also strongly believe that the more merchants provide this payment option and the more people using it the less it will cost them. The creation of critical mass is crucial in driving customers' acceptance of mobile payment. It is also interesting to learn whether the indirect impact of network externalities will be as important as direct network externalities are.

This finding supports previous research that indicates the existence of the network externalities effect in technology acceptance in general (Dahlberg and Mallat 2002; Mallat 2007), and in mobile payment in particular (Au and Kauffman 2008).

5 Conclusion and future work

This study assumed that five major predictors will influence the intentions to use mobile payment technology and they are: performance expectancy, effort expectancy; social influence, trust, and network externality. The bivariate correlations supported our premise in assuming the prediction on a one-to-one relationship bases. On the other hand, and based on absolute statistical foundation, the commonalities between predictors would not allow all assumed predictors to be significant when joint together in the proposed research model. Results indicated that all assumed constructs are significant in predicting behavioral intentions except effort expectancy. Such result supports all five hypotheses except hypothesis number one. Given the great impact of network externalities on mobile payment acceptance, it is also interesting to know that it was the highest among all assumed predictors. Finally, the predictors explained 58 % of the variance in BI.

5.1 Implications for researchers

The field of mobile payment acceptance is recent and warrants further studying. But based on this research it is

suggested that the following implications are taken into considerations:

1. When put into the model, effort expectancy did not have a direct influence on mobile payment acceptance, but might have an indirect influence through performance expectancy. So for future adoption of the model, it is preferable to study the influence of effort expectancy (ease of use) through path analysis. Also, it might be important to explore other paths that are not reported in the literature.
2. Given the importance of network externalities on mobile payment acceptance, it is best to have it included in future mobile payment acceptance studies. Even though it is not a common construct in technology acceptance models (TRA, TAM, DIT, SCT, and UTAUT), it should be emphasized as a major predictor of technology acceptance. Future work should import also other new constructs that might relate to specific context (technology, culture, or paradigm).
3. Performance expectancy remains an important predictor of technology acceptance. Despite coming second to network externalities, it is a dominant construct in technology acceptance research. Its inclusion seems to boost the explanatory abilities of any model.

5.2 Implications for practitioners

Being able to understand the factors influencing customers' acceptance of mobile payment, merchants, banks, and other types of businesses need to watch for the factors influencing the adoption of such technology (mobile payment). The global market is competing fiercely to gain customers and retain them, where they are employing data mining techniques to understand customers' behaviors (Hassouna et al. 2015). Our model aids service providers to build their marketing policies that target mobile payment users in a successful manner. The special intention that the respondents gave to the effect of network externalities, implies that it is important for service providers to build a critical mass. Customers seem to be willing to use mobile payment services if there are enough merchants that provide this payment method, and large size of users of such technology.

Trust is also an issue to bear in mind, the willingness of customers to accept this payment service is very much tied to their ability to trust the technology as much as it's about trusting its service provides. Managing the organization image and creating a trustworthy brand name may have to precede offering mobile payment service.

5.3 Recommendations (technical implications)

As customers tend to put great emphases on performance expectancy (the second most influential predictor of mobile payment acceptance), system developers should take that into account as they design mobile payment systems. The functionalities of such systems may or may not help improve its uptake. Developers should try to maximize the number of mobile payment types supported by the application, its ability to handle different currencies, and the processing speed (Global Payment 2014).

Developers should focus on another important aspect that is neglected in research which is: how to build trust through website design? System features influence customers trust. For example Alexander et al. (2010) have found that system transparency is one of the most influential features with respect to trust. Transparency includes the clarity of usage terms, clear distinction between content and advertisement, and the consistency of material offered across web pages.

5.4 Limitations and future work

This research suffered from a small sample size that would provide better generalizability of results. Even though statistical resources (Hair et al. 2009) support generalizability when the sample is greater than 100 cases, still larger samples guard for many biases and strengthen the power of this research. The second issue is the instrument validity and reliability, especially when language is an issue. Research in Nigeria supported the influence of survey language on research results (Abu-Shanab and Md Nor 2013), which calls for future use and repeated validation of instrument. Another instru-ment related issue is the choice of items measuring a construct, as we utilized a set of items from previous research that can be disputed by other researchers in defining a construct (i.e., network externality). The choice of items representing a construct defines its con-tent validity and can be considered in future research and operationalized better by other researchers.

The choice of research model and the choice of moderating and mediating variables are related to the conceptual premise, and thus different variables might be utilized by other researchers. It is important also to consider the proposition of the UTAUT 2 in the Nigerian environment, which was proposed by Venkatesh et al. (2012) and included predictors like hedonic motivation, price value and habit. The type of technology under consideration is another determinant of such choices. Future research should be directed to study the influence of demographic factors specifically income, as it might relate to financial transactions when exploring the adoption of payment technologies.

Appendix

Table 8 Original Sources for items used to build the instrument

Item	Source
Effort expectancy	
Learning how to use mobile payment is easy for me. My interaction with mobile payment is clear and understandable.	Venkatesh et al. (2012); Peng et al. (2011)
I find mobile payment easy to use.	
It is easy for me to become skillful at using mobile payment	
Performance expectancy	
I find mobile payment useful in my daily life. Using mobile payment increases my chances of achieving things that are important to me.	Venkatesh et al. (2012); Peng et al. (2011)
Using mobile payment helps me accomplish things more quickly.	
Using mobile payment increases my productivity	
Social influence	
People who are important to me think that I should use mobile payment People who influence my behavior think that I should use mobile payment	Venkatesh et al. (2012); Peng et al. (2011)
People whose opinions that I value prefer that I use mobile payment	
Trust	
Mobile payments are trustworthy I believe that data sent is confidential	Zmijewska et al. (2004)
I get immediate confirmation message of the transaction	
I trust mobile payment systems to be reliable.	Gefen (2000); Jarvenpaa et al. (2003)
Network externalities *If more and more merchants accept mobile payment, then:*	
The quality of mobile payment services will improve. A wider variety of mobile payment services will be offered.	Yu and Tao (2007); Katz and Shapiro (1992)
Customers will have to pay less to use mobile payment services.	
Behavioral intentions	
I intend to use mobile payment in the future. I expect that I will use mobile payment in my daily life.	Venkatesh et al. (2012); Peng et al. (2011)
I plan to use mobile payment frequently.	

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